RECENT AUSTRALIAN VIVIPARIDAE AND A FOSSIL SPECIES

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Fig. 1-20.

Like most species of Australian fresh water mollusca, those belonging to the family *Viviparidae* have received little attention from conchologists.

Smith (1) commenting on the genus *Viviparа* remarks that "Two peculiarities are constant in all Australian species of this genus. Every example that has come under my examination exhibits spiral sculpture; and in none of them are colour bands found below the periphery". One species *V. alisoni* Brazier (2) (type locality Diamantina River, Queensland) was described as smooth, but a close examination of typical specimens from Ayr, Lower Burdekin River, Queensland, shows even under a magnification of 40 diameters, the peculiar microscopic granose spiral lirae common to all Australian species. The genus *Notopala* is here erected for the Australian species exhibiting this sculpture.

Notopala gen nov.

Shell globuse-conic, subumbilicate, whorls five, ventricose, with a tendency to angulation subsuturally and at the base; epidermis olive, polished; sculpture of microscopic granose lirae on the whole of the outer surface; aperture subovate, operculum corneous, nucleus subcentral, nearer the columella margin; unicoloured or with spiral colour bands on and above the periphery. Animal oviviparous, living in mud at low water mark and below in fresh water rivers and lakes.

Genotype. *Paludina hanleyi* Frauenfeld, from the Lower Murray River. A chronological list of species, represented in the South Australian Museum Collection, which may be referred to this genus, is given here.

Notopala sublincata Conrad, 1850 (type loc., Darling River, N.S.W.).
Notopala essingtonensis Frauenfeld, 1862 (type loc., Port Essington, N.A.).
Notopala hanleyi Frauenfeld, 1862 (type loc. Lower Murray River, S.A.).
Notopala australis Reeve, 1863 (type loc., Victoria River, N.A.).

(1) Smith, E. A., *Proc. Linn. Soc.*, 1881, xvi, p. 262.

(2) Brazier, J., *Proc. Linn. Soc., N.S.W.*, 1879, iii, p. 221.

Notopala ampullaroides Reeve, 1863 (type loc., Victoria River, N.A.; also Fitzroy River, N.W.A., Smith); syn. of *N. essingtonensis* Frauenfeld.

Notopala kingi Ads. & Ang., 1863 (type loc., King's Ponds, C.A.).

Notopala waterhousei Ads. & Ang., 1863 (type loc., Newcastle Waters, N.A.).

Notopala intermedia Reeve, 1863 (type loc., Lower Murray River); syn. of *N. hanleyi* Frauenfeld.

Notopala polita Martens, 1863 (type loc., Balonne River, Q.).

Notopala affinis Martens, 1865 (type loc., Fitzroy River, N.W.A.).

Notopala purpurea Martens, 1865 (type loc., Murray River); syn of *N. hanleyi* Frauenfeld.

Notopala suprafasciata Tryon, 1866 (type loc., Tropical Australia); syn of *N. essingtonensis* Frauenfeld.

Notopala alisoni Brazier, 1878 (type loc., Diamantina River, Q.).

Notopala tricincta Smith, 1882 (type loc., N.A.); closely allied to *N. essingtonensis* Frauenfeld.

Notopala dimidiata Smith, 1882 (type loc., Victoria River, N.A.).

NOTOPALA WANJAKALDA sp. nov.

Shell globose conic, body whorl bi-angulate, bearing a valid carina at the lower angle; umbilicus small; whorls five, the protoconch and first and second whorls eroded; surface with characteristic australoid microscopic spiral granose lirae; aperture subovate; outer lip continuous with columella lip and medially produced into a prominence corresponding with the carina.

Holotype. Height 6 mm., diam. 17 mm. Fossil (Upper Pleistocene?). In the banks of the River Murray near Sunnyside, Section 174, Hundred of Burdett, horizon 9. D.11451 S.A. Museum.

The species differs from the recent *N. hanleyi* Frauenfeld in the valid unicarination exhibited in some forms, the tendency to sharper angulation of the whorls and the coarser spiral granose lirae which are well preserved in most specimens.

Mr. C. P. Mountford recently brought to the South Australian Museum some shells taken from the banks of a dead creek which entered the Murray near Sunnyside four miles upstream from Murray Bridge, South Australia, Section 174, Hundred of Burdett. The specimens were collected by Mr. Mountford during a trip to this area in company with Drs. C. Fenner, T. D. Campbell, and C. Hackett. Amongst the specimens was a remarkable unicarinate fossil *Notopala* unlike any recent Australian species. Three visits were made to the site by the author to make further investigations. The Murray River cliffs rise to a height

of 300 feet above river level at this point. A section of the cliffs, disclosed by the creek's bank may be tabulated thus:

Horizon.	Composition.	Thickness.	Height above river level and approximately above sea level.	Remarks.
1	Surface yellow sand	60 cm.	93 metres	
2	Packed mussel shells *Hyridella proto-rittatus* in blackened sand	30 cm.		Probably a native camp-site. Some other layers exposed near this site have not the blackened appearance, and represent old river levels.
3	Yellow sand	15 cm.		
4	Dark sand	53 cm.		
5	First layer of *Notopala*	10 cm.		*Notopala* sp. visible only at certain places.
6	Yellow sand	36 cm.		
7	Second layer of *Notopala*, cf. *wanjakalda*	10 cm.	91 metres	Plainly visible for horizontal distance of about 3 metres.
8	Yellow sand	76 cm.		
9	Third layer of *Notopala wanjakalda*	15 cm.	90 metres	Partly obscured by recent falls of surface sand.

Horizon 5 contains numerous closely-packed specimens of a fossil *Notopala* nearly allied to the recent *N. hanleyi* Frauenfeld.

Horizon 7 contains just as closely-packed specimens of *Notopala* c.f. *wanjakalda* ranging from a non-carinate to a prominently carinate form. This carina is situated at a lower angle of the body whorl. On the penultimate whorl it is covered by the upper margin of the body whorl, but juvenile specimens show the carina to have been present at a very early stage. In Horizon 9 a similar series of *Notopala wanjakalda* is found where 40 per cent. show signs of unicarination.

The holotype of *Notopala wanjakalda* was taken from this lowest horizon. The species found in horizon 7 is probably identical.

The narrow compact horizons (5, 7, 9) at which the *Notopala* were obtained probably represent old river levels; members of this genus are found living most abundantly in the shallow marginal waters near low river level. It will be noticed that the lowest horizon is 90 metres above present river level, and the occurrence seems to show the existence of a base level of low water much above that of the present river level.

This is of interest because on other grounds Tindale (3) has shown the probability of a series of Pleistocene marine terraces occurring in the region of the Murray River, the oldest near Fromm Landing and successively younger ones between there and the present coast line.

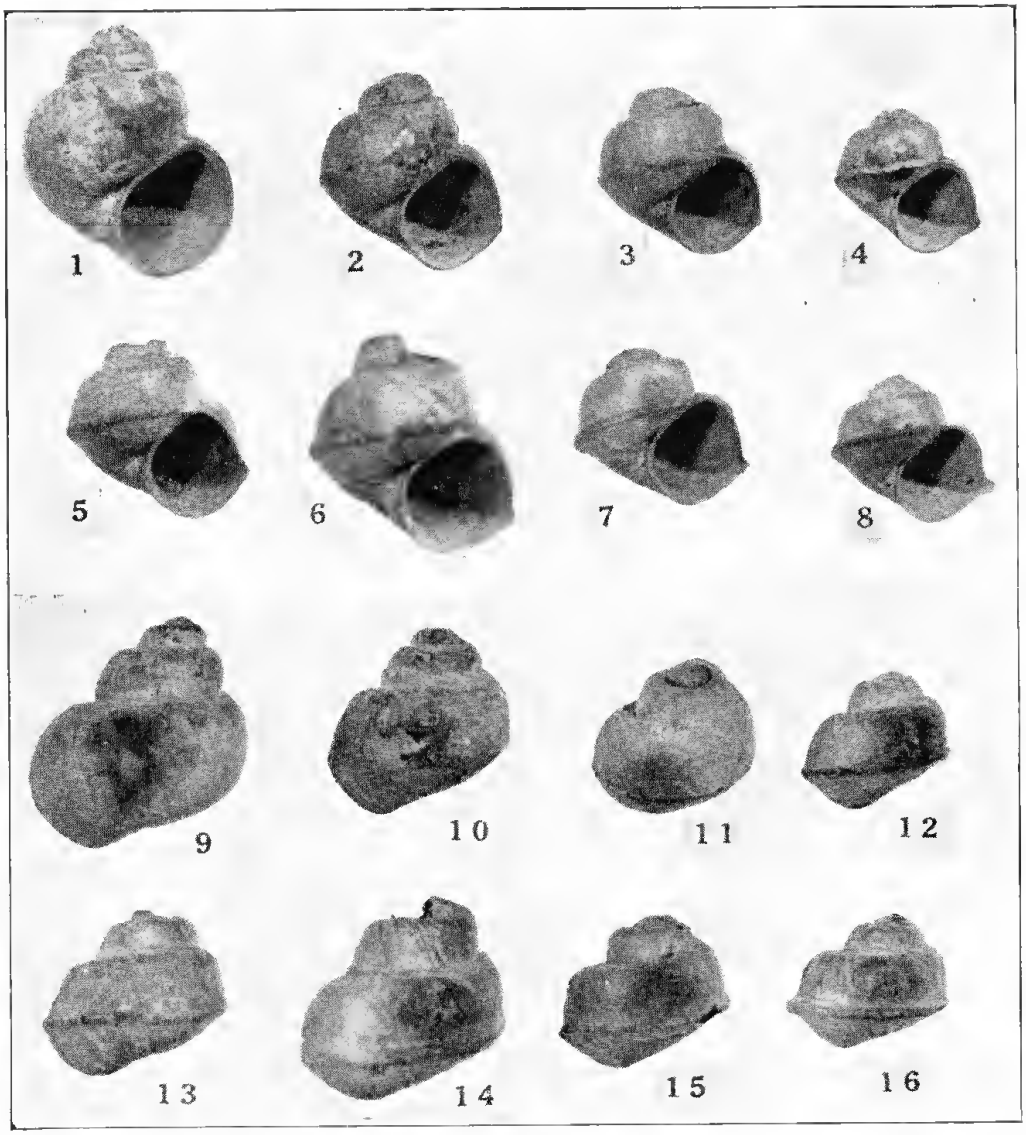

Fig. 1–16. *Notopala wanjakalda* sp. nov. 1–8, Ventral views; 9–16, dorsal views (8 and 16 show the holotype). All nat. size.

Does this *Notopala wanjakalda* horizon correspond with Tindale's Reedy Creek Terrace? The sculpture of the shell may indicate a warmer climate than now exists at this place, as the raised beach marine fossils do elsewhere in South

(3) Tindale, N. B., *Trans. Roy. Soc., S. Aust.*, lvii, 1933, pp. 137, 139.

Australia. Associated with the *Notopala wanjakalda* are odd specimens of a fresh water mussel rather different in shape from the recent *Hyridella australis* Lamarck, being more like the *Hyridella angasi* Reeve in general contour.

The native camp site layer has specimens of a fresh-water mussel probably allied to the recently extinct *Hyridella prolorillata* Hale & Tindale (4) which was the dominant food shell of the natives who lived on the Tartangan camp site at Tartanga.

CENTRAPALA gen. nov.

Shell subglobose, thick, imperforate; spire depressed, obtuse, eroded at the apex and early whorls; suture much impressed; whorls four, rounded, somewhat flattened posteriorly and sculptured with prominent lirae, six or seven on the penultimate whorl, with sometimes a fine interstitial; base obsoletely spirally

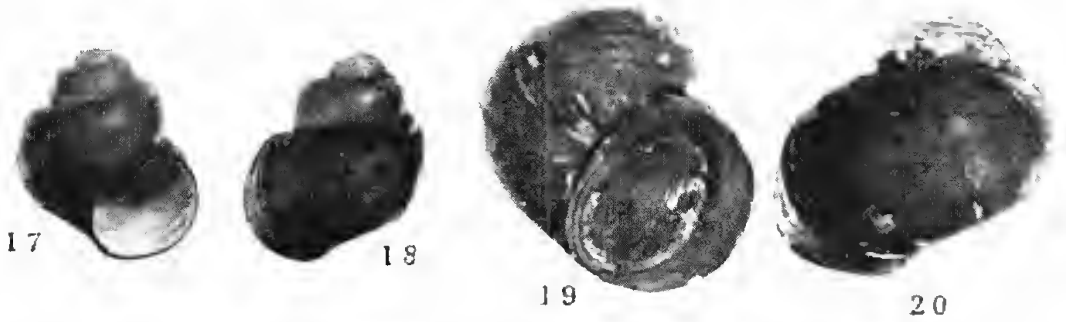

Fig. 17–18. *Notopala hanleyi* Frauenfeld. Nat size. Fig. 19–20. *Centrapala lirata* Tate. × 1½.

sculptured; operculum horny, concentric, nucleus nearer the columella margin; animal oviviparous giving birth to six or eight embryos of 3 mm. diameter.

Genotype. *Paludina lirata* Tate. Cooper Creek at Innamincka, C.A. (Holotype D.11450 S.A. Mus.).

Embryonic shells diaphanous, pale green, carinated on the periphery of the last whorl and the base strongly striated.

In 1885 Tate (5) introduced *Paludina lirata* remarking that: "The species is quite unique amongst Australian congeners". It is certainly generically distinct from any other species, being somewhat like a lirate *Larina*, though probably more nearly related to *Notopala*. Tate's figure of the type is not accurate, so the specimen is here refigured.

(4) Hale, H. M. and Tindale, N. B., *Rec. S. Austr. Mus.*, iv (ii), 1930, p. 156.

(5) Tate, R., *Trans. Roy. Soc., S. Aust.*, ix, 1885, p. 63, pl. iv, fig. 6a–b.

Readily distinguished from all other genera of this family by the spiral sculpture, depressed obtuse spire, impressed suture, large, oblique semi-circular aperture and rounded, not subangulate whorls.

The genus *Larina* Adams (genotype *L. strangei* Adams) is recorded from fresh water at Moreton Bay and Mackenzie River. Thiele places *Larina* in the family *Melaniidae*. Gatliff and Gabriel ([6]) described *Larina ? turbinata* from five fathoms, Western Port, Victoria, and later made it the genotype of *Larinopsis* Gatliff and Gabriel ([7]). Thiele places this genus as a section of *Megatomphalus* Brusina 1871, which is located in the family *Fossaridae*.

(6) Gatliff, J. H. and Gabriel, C. J., *Proc. Roy. Soc., Vict.*, xxii (n.s.), 1909, pl. i, p. 35.

(7) Gatliff, J. H. and Gabriel, C. J., *Proc. Roy. Soc., Vict.*, xxix (n.s.), 1916, pt. 1, p. 104.